Accounting and Management Information Systems
Vol. 22, No. 4, pp. 746-754, 2023
DOI: http://dx.doi.org/10.24818/jamis.2023.04007

A reverse-engineered pitch on "Defensive versus evidence-based medical technology: Liability risk and electronic fetal monitoring in low-risk births

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Abstract

This pitching research letter (PRL) describes the application of the pitching research template introduced by Faff (2015, 2021) to a reverse-engineering process in the practice of electronic fetal monitoring (EFM) as a form of defensive medicine with regard to the field of medical technology. The pitch structure underlines a succinct and streamlined approach to recapitulate key components of scientific studies that form the basis upon which a researcher's scientific or seminal research work is assembled.

Keywords: Pitching Research, Reverse Engineering Pitch, Medical Technology, Defensive Medicine, Electronic Fetal Monitor

JEL codes: K32, N7

1. Introduction

This letter presents an application of Faff's (2015, 2021) pitch template within the context of "*reverse engineering*" to aid novice researchers in determining a worthwhile research topic that can serve as a foundation for their own research. The following approach comes in two variants: first, as an owned "ex-post" pitch

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where the pitcher completes a pitch for their ongoing or already published research as a progress check that their research is on course. Second, the alternative pitch involves reverse engineering existing research conducted by a "third party."

In this letter, the authors reverse-engineered a "third-party" paper. The fundamental idea of reverse engineering complements that of the procedure applied to enhance existing products wherein deconstruction of the design of a product is salient to gaining a deeper understanding of its functionality. This is key to the final quality of a scientific study, which is contingent on a robust beginning wherein having a clear understanding of research directions and objectives determines the success of the former. Crucially, accurate interpretation of the literature is essential to determine a topic of novel contribution to stakeholders and development of knowledge within the research field. Yet, researchers often find it challenging to pinpoint the pertinent information from contradictory results where objectivity is paramount, and, consequently, a significant amount of time is devoted solely to reading literature.

Thus, using Faff's (2015, 2021) pitch research template as a foundational planning guide will benefit researchers in extracting the essential information of a paper most relevant to their research. Accordingly, the itemized reverse-engineering pitch framework enables a clear dissection of the main idea that is evident in but is not limited to the key findings (Item K: Three Key Findings) and methodology (Items F&G: Data and Tools). By first identifying the key information of a scholarly study, valuable time is not wasted on a potential addition to the relevant literature that may, regrettably, turn out to be inconsequential.

Given the elements of a research pitch are similar to those of reverse engineering, differing only in Item K: Other Considerations, which compels researchers to consider additional matters germane to their research including future collaborations and ethical risks, one can perceive it as a learning tool. Thus, it is a valuable tool to assist with a concise, systematic organization of information and thereafter, facilitate efficient proposal communication with academic experts or the broader community.
The remainder of the letter is arranged as follows: Section 2 elucidates the background information and provides a brief overview of the topic of malpractice liability and defensive medicine. Section 3 explicates the reverse-engineering process using a pitch template. Section 4 elaborates on a personal reflection from the first author on the newfound knowledge and skills acquired throughout this process and the subsequent benefits derived from it, while Section 5 concludes the essay.

2. Background information and topic overview

As a context for this letter, the first author does not have a background in high-level academic research, being a senior high school student with an ardent passion for science-centered topics. Defensive medicine was found to be a topic worthwhile to be explored due to its increasing rise as a medicolegal matter. Nevertheless, the first author still experienced difficulties in narrowing down relevant literature for further exploration or even potential research areas. Therefore, collaboration was sought with Kun Hing Yong. As the co-author partook in the 'Research Process in Business RBUS6914' course and had experience with PRL publications (Yong, 2019; Yong & Chu, 2023), I was imparted the knowledge of Professor Faff's (2015, 2021) pitch research framework. It is undoubtedly a valuable learning tool to come to grips with.

Defensive medicine, a medical practice that involves excessive operation of tests and technology to exonerate health professionals from liability, has been a prevalent approach for many decades, often used without fully comprehending their risks, efficacy, and financial implications. Over the last two decades, it has garnered considerable scrutiny from both the professional and community spheres. As growing concerns are raised regarding its impact on the quality and cost of healthcare, abundant studies have been dedicated to examining this topic.

A very recent and equally significant empirical study identified was Roth's (2023) study, published in the journal, *Social Science & Medicine*. The article extends state-level variation in liability risk via tort reforms (caps on damages, Joint and Several Liability (JSL) reforms, expert requirements) and rates of obstetric malpractice lawsuits into the context of EFM use in low-risk births. To gain a deeper understanding of the various uses of the pitch format, it was suggested that the first author conduct a reverse-engineered pitch on the research article. This will also help develop the skills needed to enable the completion of research projects and hence, aid in progression on a research trajectory.

3. The reverse-engineering process

As per the initial pitch template, the reverse-engineering template is built around three predominant stages in which include the *pre-pitch* for the broader picture (Items A-D), the *core pitch* for narrowing down the constituents of the pitch (Items E-J), and, finally, the *supplementary* elements (Item K) (Faff, 2015). Regarding the various subcategories, albeit designed in a consecutive manner to distinctly expound the logical flow and connection between the pitch elements, the pitching process itself can be aptly conceptualized as a non-sequential undertaking. The completed reverse-engineered pitch is provided in Table 1.

The *Working Title* of this PRL*,* the first segment, cites the title of the selected article. This facilitates greater convenience and efficiency in referring back to the article when writing the pitch, while also adeptly captures the connection between

the broad idea of medical technology with the specific elements of liability risk and EFM.

The *Basic Research Question,* the second segment, is guided by the hypotheses. It examines the interrelationships between liability risks and implementation of non-evidence based medical technology like EFM in low-risk births. The research question is argued to be non-trivial, as it narrows the specifics that are sufficient for data collection and analysis.

The *Key Papers* is the third segment. In this pitched paper, three papers were selected based on their interlinkage with malpractice liability, continuous EFM use and maternal and pregnancy characteristics. First, a review paper by Alfirevic *et al.* (2017) is chosen, given its frequent mention in the pitched paper; it compares the efficacy and safety of continuous cardiotocography with intermittent monitoring as a practice of EFM for fetal assessment during labor. Second, a research paper by Born and Karl (2016) in the *Journal of Empirical Legal Studies* that examines if changes to the tort liability system concur with shifting market dynamics for medical malpractice insurance is chosen, as it takes a medicolegal approach. Third, a research paper by Braun *et al.* (2016) is chosen, which explores trends in the prevalence of congenital spastic cerebral palsy in babies born in a heterogeneous United States metropolitan area. This exercise holds significant value, as it unveils the papers relevant to the reviewed article that can benefit the pitcher's own future research.

The *Motivation/Puzzle*, the fourth segment, denotes the scholarly factors that propel the study. It is a broad picture seeking to address a meaningful research gap identified in the literature, such instances may be real-world phenomena, the need to develop new theories or models, or the aim to make substantial contributions to policy. This letter is motivated by the practice of defensive medicine to avert prospective malpractice lawsuits. This is academically relevant by connecting to real-world scenarios where enforcement of liability-avoidance protocols is prevalent in medical settings to avoid consequential financial and reputational losses ensuing malpractice claims. Thus, the reverse engineering pitch serves as a constructive learning and practice tool for pitchers to hone their skills before the real pitch, which would require much more revisiting and refining of response.

The *Idea,* the second segment, is the central driving force behind the paper. In this pitched paper, the idea is succinct and clear, with core hypotheses logically derived from the research question and motivation. The hypotheses are specific to the direct and indirect liability risks as noted in Table 1. Moreover, the paper also addresses the endogeneity concerns, notably from a hospital point of view involving data misreporting or data quality problems regarding EFM use. Nevertheless, these issues were considered unlikely to substantially affect changes in results on malpractice liability, implying the idea is scientifically sound.

The *Data,* the sixth segment, in the context of reverse engineering, is the relevant details about the data type, sample size, and sources from which the data was obtained. This is clearly specified in the data and methods section.
The *Tools,* the seventh segment, specifies the analytical approach in which the findings were obtained, holding a particular significance in empirical research as it adds to the credibility and reliability of the inferences drawn. A quantitative study would typically involve statistical analysis. With respect to this study, it applies multi-level logistic models as an unbiased estimate to test the impacts of explanatory variables on its binary outcome, and later, verified using logistic regression models in SAS. On the other hand, qualitative studies employ interview- or focus group discussion- designs to establish a methodological framework. Nonetheless, not all information regarding the tools may always be provided. Thus, it may require prior knowledge of the tools for readers to sufficiently extract all relevant information.

What's New?, the eighth segment, outlines the novelty of the research paper, which should not replicate existing literature but rather build upon current knowledge (Faff, 2021). While certain papers may explicitly accentuate the novelty of their research, others may not do so directly. In such cases, meticulous examination of the literature review, methodology or discussion sections, is pertinent. The required novelty can then be illustrated in the form of a Mickey Mouse Venn Diagram as it lies in the intersection of the three distinct spheres of research attention (Figure 1).

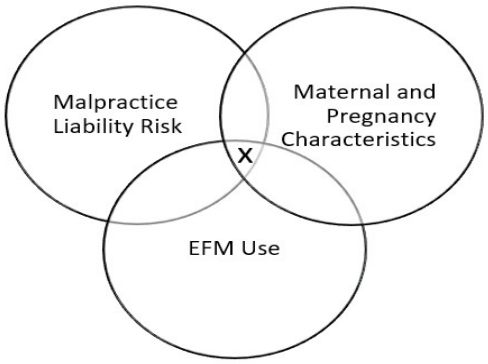

Figure 1. Mickey Mouse Diagram illustrating the novelty of Roth's (2023) study

The ninth segment is the *So What?* question. The ensuing step of identifying the novelty of the article is to examine how the research outcomes of the study will be of value and benefit to stakeholders such as policymakers. Several key questions are useful for consideration, including:

- How will the stakeholders benefit from this?
- Does it reflect a current increasing trend?

- Will it inform policymakers of relevant measures that should be taken to address an issue?
- To what extent is the quality of the findings, and will it affect major decision-making that will improve the identified phenomenon?
- How does it change the way we think?

This pitched paper carries key implications for policymakers and regulators, helping them to evaluate the extent to which defensive medicine should be used to ensure patient care is not compromised.

Contribution, the tenth segment, is similar to the previous element. This pitched paper characterizes the consequential theoretical or practical contributions of EFM use. However, its findings indicating tort reforms that attenuate medical liability risk inadvertently promote defensive medicine could lead to future research directions, or as suggested by Roth (2023), future research can examine applications to other defensive medicine that enhance organizational efficiency rather than patient care.

Other Considerations, the eleventh and concluding segment, centers around the final reflections and suggestions. However, in reverse engineering, it summarizes the three key findings from the paper, which should address whether it supports or refutes existing theories or offers a new perspective on the phenomenon subjected to investigation.

4. Personal reflection

The reverse-engineering exercise was a steep learning curve, not only for me, but for numerous other pitchers as well. My approach to reading and identifying relevant papers prior to being cognizant of the pitch template would result in an extensive quantity of annotated notes, with attempts at making connections to further narrow the topic. When it came time to draft papers, I would revisit the labels to make sense of the association between one point to the other, but nevertheless, the compiled notes may at times be redundant or insignificant, rendering the previous efforts futile and inefficient. This is principally due to an unfocused and ever-evolving "Idea", which may at times lead to the exploration of alternative fields of inquiry.

The guidance of my mentor regarding the application of reverse pitching helped clarify the various elements of research. Despite the required completion of several repetitive readings of respective articles to comprehend the concepts, results and meanings presented within, it proved instrumental in improving the consistency of my research findings and hence, my research progress. In addition, the manual process of aligning the ideas of the paper with elements of the itemized framework will enhance a researcher's ability to evaluate early on if a chosen study is suitable for progression. A large quantity of unfilled items may either signify the necessity for iterative reading or potentially, correspond to flaws in the execution of paper.

Engaging with this planning and learning tool requires practice, particularly since certain factors may not be explicitly listed within the papers. However, the investment of time is undoubtedly worthwhile. This exercise has helped me to gain insights into the thought process involved in developing a research proposal and thereafter, refine my research strengths and address my weaknesses. As a result, I am now better equipped to optimize my time in allocation of a realistic and reasonable timeframe for finding important papers and drafting a research proposal. This, in turn, will increase efficiency in the communication of initial thoughts with my mentor and teachers so that valuable and constructive feedback would be received, given that research is an iterative process.

5. Conclusion

Faff's (2015, 2021) pitch framework is an indispensable addition to the academic research community. In spite of its initial goal to facilitate an insightful discussion between the pitcher and pitchee (mentor) in a time-efficient way that would lead to "probing questions" and "targeted feedback" (Faff, 2021), it is versatile in its application to additional research areas. In relation to the following paper, the author employed a reverse engineering method that has consequently helped develop better insight into the basic relationship between changes in tort reforms and the practice of defensive medicine. This exercise serves as a foundational cornerstone upon which an original pitch can be instigated, and herein lies the pillar to the success of a research proposal, given that the final quality of paper depends on how well the researcher understands and apply the concepts. Based on my positive personal experience, I would encourage fellow researchers to consider using the pitch template before embarking on a research topic.

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Table 1. Completed reverse engineered pitch template for Roth's (2023) study

Pitcher's Name	Elizabeth Yong Kun Hing Yong	FoR category	Medical Technology	Date Completed	09 July 2023
(A) Working Title	Liability risk and electronic fetal monitoring in low-risk births: A reverse engineered pitch				
(B) Basic Research Question	Do tort reforms that reduce providers' liability risk encourage less EFM use? Does the use of non-evidence-based medical technology also respond to these legal changes?				
(C) Key paper(s)	Alfirevic, Z., Gyte, G.ML., Cuthbert, A. & Devane, D. (2017) "Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour", *Cochrane Database of Systematic Reviews*, Issue 2: 1-108 Born, P.H. & Karl, J. B. (2016) "The effect of tort reform on medical malpractice insurance market trends", *Journal of Empirical Legal Studies*, vol. 13, no. 4: 718-755 Braun, K.V.N., Doernberg, N., Schieve, L., Christensen, D., Goodman, A. & Yeargin-Allsopp, M. (2016) "Birth prevalence of cerebral palsy: A population-based study. *Pediatrics*, vol. 137, no. 1: 1-9				
(D) Motivation/Puzzle	The rising frequency of malpractice lawsuits against physicians contributes to a proportional escalation in fear of malpractice liability, considering the severe financial and reputational losses and restrictions on providers' ability to acquire hospital privileges and liability insurance ensuing a birth injury or death. Although the perceived risk usually exceeds the objective risk, the ingrained pressure to fear malpractice liability can affect medical judgement, resulting in a practice known as *defensive medicine*. The overuse of tests and technology is to avert the likelihood of a devastating outcome from pregnancies and hence, malpractice lawsuits, given technology is perceived as a "scientific" symbol of superior medical care. For instance, continuous EFM remains employed by obstetricians in hospitals despite its high rate of false positives (a test outcome that incorrectly indicates the fetus is in distress). This leads to unnecessary interventions in labour while also not demonstrated to improve outcomes of low-risk pregnancies as opposed to intermittent monitoring.				
THREE	Three core aspects of any empirical research project i.e. the "IDioTs" guide				
(E) Idea?	The core idea is to investigate the impact of state-level variation in liability risk via tort reforms on EFM use. Direct reforms (caps on damages, non-economic damages, punitive damages), indirect reforms (JSL rules, Proportionate Liability (PL), expert requirements) and rate of obstetric malpractice claims between the 1995-2003 period are considered as the key explanatory variables. Roth (2023) proposes that tort laws that reduce liability insurance premiums should influence the providers' perceived risk and, resultingly, discourage extensive EFM use.				
(F) Data?	**Country:** The United States of America **Unit of Analysis:** EFM on Low-risk births and Tort Laws **Sample Period:** 8 years (1995-2003) by month and year **Data Type:** Maternal and pregnancy characteristics, state economic and health care environment, tort laws-specific and macro-level **Sample Size:** 1,497,046 low-risk births				

Pitcher's Name	Elizabeth Yong Kun Hing Yong	FoR category	Medical Technology	Date Completed	09 July 2023
(G) Tools?	1) Multi-level logistic models (MLM) are implemented to test the effects of explanatory variables (variation in liability risks, maternal and pregnancy characteristics) on binary outcome (EFM use) in low-risk births. As a robustness check, logistic regression models are run, with PROC GLIMMIX in SAS to estimate the models. 2) Models were performed using indicators for liberal (ideology score > 60) and conservative (ideology score <40) ideology as well as ordinal measures (conservative, moderate, and liberal). This is tested due to the possibility that politically conservative states could influence types of tort reforms established and EFM utilisation.				
TWO	**Two** key questions				
(H) What's New?	This study builds on existing literature that tort reforms, albeit projected to be associated with lower routine use of *defensive medicine* due to a limit in the liability cost, may inadvertently promote higher technological intervention during labour among physicians. Whilst previous research examined the aspects broadly or focused on different areas, this paper represents the first to implement multi-level logistic models on its analysis regarding the routine use of continuous electronic foetal monitoring in low-risk births.				
(I) So What?	Empirical research indicates probability of EFM use is not decreased by objective levels of liability risk for certain tort reforms (damages caps, expert requirements). It suggests that leveraging the efficiency to perform unnecessary diagnostic tests in medical settings elevates the risk of negligence and medical errors. This will inform policymakers and regulators of the measures taken to limit the use of defensive medicine to provide higher-quality care to patients.				
ONE	**One** bottom line				
(J) Contribution?	Provides the foundation for future research investigating whether the same relationship applies to other medical technologies that improve organisational efficiency but lack improvement in patient care. Furthermore, it highlights the severity of misusing medical technology; an instance is utilising EFM to reduce nurse-patient ratios in the obstetric nursing rooms, which will jeopardise the patient's (labouring mother) safety as nurses are unable to recognise if something is going wrong. Consequently, this helps inform the decision-making of policymakers in discouraging such practices.				
(K) Three Key Findings	1. The probability of reporting EFM in low-risk births is higher when states initiate cap damage awards, suggesting a limit in liability risk does not correspond to higher quality care. 2. Statistically significant effects were evident for most maternal and pregnancy characteristics, while higher probability of EFM use is associated with maternal age, non-Hispanic white births, weight gain of more than 45 pounds, more prenatal care, and induction and stimulation of labour. 3. Reform of the JSL rule is correlated with higher EFM use, supporting the hypothesis as under the JSL rule. Expert requirements parallel to a high probability of EFM use, contradicting the hypothesis. The number of lawsuits has no discernible influence on EFM use.				